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PATENT SPECIFICATION 705,891

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COMPLETE SPECIFICATION

Improvements relating to Steel Dolphin Piles

We, DEUTSCHE MANNESMANNROHREN-WERKE AKTIENGESELLSCHAFT, formerly known as Westdeutsche Mannesmannrohren Aktiengesellschaft, a German Company, of 125 Ulmenstrasse, Duesseldorf, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to steel dolphin piles consisting of a single tube or of a number of tube sections welded or otherwise rigidly connected together. As is known, "dolphin piles," in contrast to so-called foundation piles, project with the greater part of their length above the sea bottom and are subjected to severe bending stresses when a ship alongside them bears against them.

The object of the invention is to effect in a simple manner an adaptation of the pile to mechanical stresses, more especially bending stresses in the use of the pile, which differ along the length of the pile.

According to the invention, this object is fundamentally achieved by giving to the dolphin pile a strength which varies in stages along the length of the pile.

A preferred constructional form of the invention is one in which the dolphin pile consists of at least two tube sections arranged end-to-end in the longitudinal direction of the pile and connected together by welding.

The characteristic that the pile has a strength which differs in stages lengthwise of the pile can be obtained in one or other of the following ways:—

According to one way, there may be employed for the pile a steel the material properties of which, more especially the yield point values, vary in stages lengthwise of the pile.

Various possibilities exist for carrying this form of the invention into practice. If the dolphin pile is produced in one piece from a steel of normal composition, for example in the form of circular tube or of some other rolled section, the region of the length of the pile which is subjected to the greatest mechanical stress may be heat treated in order to increase the yield point, if desired by utilising the rolling heat.

Alternatively, the pile may consist of at least two longitudinal sections, preferably connected by welding, which have different material properties, more particularly yield point values. In this case, a steel of the same quality may be employed for the two longitudinal sections and the section which is subjected to the greater mechanical stress may then be heat-treated, if desired by utilising the rolling heat, the section which is subjected to the lower mechanical stress being left untreated. However, it is preferable to use a steel of higher quality for the section which is subjected to the greater stress. If, for example, a carbon steel having a yield point of about 36 kg/mm², of the type normally employed for dolphin piles, is used for the section which is subjected to the lower stress, it is necessary to employ for the more highly stressed section a higher quality steel, for example an alloy steel, having for example a yield point of 46 kg/mm². In the case of dolphin piles consisting of a number of tube sections, the tube steel usual for this purpose will preferably be combined with another tube steel, such as that normally employed, for example, for tubes of deep boring gear. The assembly of the dolphin pile from a number of sections to be welded together generally does not involve any additional expenditure, since it is necessary particularly in the case of heavy dolphins, to assemble the piles from a number of sections for transport reasons alone.

In order to render possible a satisfactory welding of the sections of the assembled pile, it is advisable to preheat the ends of the sections which are to be welded

together. The welding may alternatively take place under a protective gas or with austenitic electrodes.

According to another way of achieving the characteristic of the invention hereinbefore mentioned, the variation of the strength of the pile by stages may be obtained by increasing the diameter of the pile in the direction of the lower end of the pile by one or more steps. This increase also increases the lateral bearing surface of the pile in the ground, thereby increasing the stability of the pile under the impact of the boat without reducing the working capacity of the pile. Such a dolphin pile may also be made in one piece, i.e. in the manner of a stepped steel tubular post, or it may be composed of at least two tubes welded together. In this case, the lower tube is preferably constricted or conically tapered at the connecting end to about the diameter of the following higher tube. The tubes may be butt-welded together or they may be introduced one into the other at their connecting ends and then welded.

According to another way still, the dolphin pile may be built up of tubular lengths having different wall thicknesses. In this case, the wall thicknesses may decrease from the top downwards if, in accordance with the proposal described in the preceding paragraph, the diameter is increased in steps in the downward direction, or the wall thickness may be fundamentally increased in steps—from the top downwards—in the individual tube lengths. It is then possible either to give the tube lengths the same internal diameters and different external diameters, or the same external diameters and different internal diameters.

Internal or external rings or bushes may be provided at the connecting points of the tube lengths.

The invention will now be further described with reference to the accompanying drawings, in which:

Figure 1 shows a dolphin pile consisting of two tubular sections 1 and 2 with a welding seam 3 and an inner sleeve 4. The upper section 2 consists, for example, of a normal carbon steel not subjected to heat treatment, as usually employed for dolphins, while the lower tube section 1 is constructed of a steel having a higher yield point;

Figures 2 to 4 show constructions of dolphin piles having external diameters increasing from the top downwards.

According to Figure 2, the tube sections 1 and 2 are butt-welded by means of the seam 3. The lower tube 1, which must be entirely or partially driven into the ground, has a substantially larger diameter than the upper tube 2. Towards the connecting end, the outer diameter of the lower tube is tapered to the external diameter of the upper tube in two steps 1*a*, 1*b*. The upper tube 2 has a smaller wall thickness than the connecting end of the lower tube 1.

According to Figure 3, the upper tube is telescoped over the connecting end of the lower tube and connected to the conical portion 6 of the lower tube by a welding seam 5.

In the example of Figure 4, the upper tube 2 is telescoped into the neck 1*b* of the lower tube. The two tubes are welded together by a fillet seam 7.

Figure 5 and Figure 6 show constructional examples in which wall thicknesses increasing from the top downwards are provided.

In the case of Figure 5, all of the tube lengths 1, 2, 1^1, 2^1, which lengths are connected by welding seams 3 with the aid of internal rings 4, have the same internal diameter, the external diameters of the lengths accordingly increasing from length to length downwardly of the pile.

In the case of Figure 6 the tube lengths 1, 2, 1^1, 2^1, which lengths are connected by the welding seams 3 with the aid of external rings 4^1, have the same external diameter, the internal diameters accordingly decreasing from length to length downwardly of the pile.

What we claim is:—

1. A steel dolphin pile consisting of a single tube or of a number of tube sections welded or otherwise rigidly connected together, characterised in that the strength of the pile varies in stages along the length of the pile, for the purpose of adapting the pile in the use thereof to mechanical stresses, more especially bending stresses, which differ along the length of the pile.

2. A steel dolphin pile as claimed in Claim 1, wherein the pile consists of at least two tube sections disposed end-to-end in the longitudinal direction of the pile and connected together by welding.

3. A steel dolphin pile as claimed in Claim 1 or Claim 2, wherein the material properties, especially the yield point values, of the steel of which the pile is composed, vary in different regions of the pile longitudinally, thereof, for the purpose of adapting the pile in the use thereof, to mechanical stresses which differ along the length of the pile.

4. A steel dolphin pile as claimed in Claim 1 or Claim 2, wherein the steel of which the pile is composed in the region of the higher mechanical stresses is heat-treated.

5. A steel dolphin pile as claimed in Claim 1 or Claim 2, wherein the diameter of the pile is increased in one or more steps towards the lower end of the pile.

6. A steel dolphin pile as claimed in Claim 5, wherein the pile is composed of at least two tube sections of respectively different diameter which are connected together by welding, the lower section, or each lower section, being reduced or conically tapered at the connecting end thereof substantially to the diameter of the upper section, or next higher section.

7. A steel dolphin pile as claimed in Claim 5 or Claim 6, wherein the tube sections are telescoped into one another and welded.

8. A steel dolphin pile as claimed in Claim 5 or Claim 6 or Claim 7, wherein the tube sections have different wall thicknesses.

9. A steel dolphin pile as claimed in Claim 8, wherein the tube sections have the same internal diameter and different external diameters.

10. A steel dolphin pile as claimed in Claim 8, wherein the tube sections have the same external diameter and different internal diameters.

11. A steel dolphin pile as claimed in Claim 2, or as claimed in any of the Claims 3, 4 or 8, the construction being as specified in Claim 2, wherein internal or external rings are provided at the connecting points of the tube sections.

12. A method of producing a steel dolphin pile according to Claim 4, especially of steel tube, characterised in that the heat treatment of the steel is effected by utilising the rolling heat.

13. A method of producing a steel dolphin pile according to Claim 2 or Claim 3, characterised in that the welding together of the tube sections is effected after preheating of the section ends.

14. A method of producing a steel dolphin pile according to Claim 2 or Claim 3, characterised in that the welding together of the tube sections takes place under a protective gas.

15. A method of producing a steel dolphin pile according to Claim 2 or Claim 3, characterised in that austenitic electrodes are employed for the welding together of the tube sections.

16. A steel dolphin pile constructed substantially as hereinbefore described with reference to the accompanying drawings.

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705,891 COMPLETE SPECIFICATION
3 SHEETS

Fig. 1

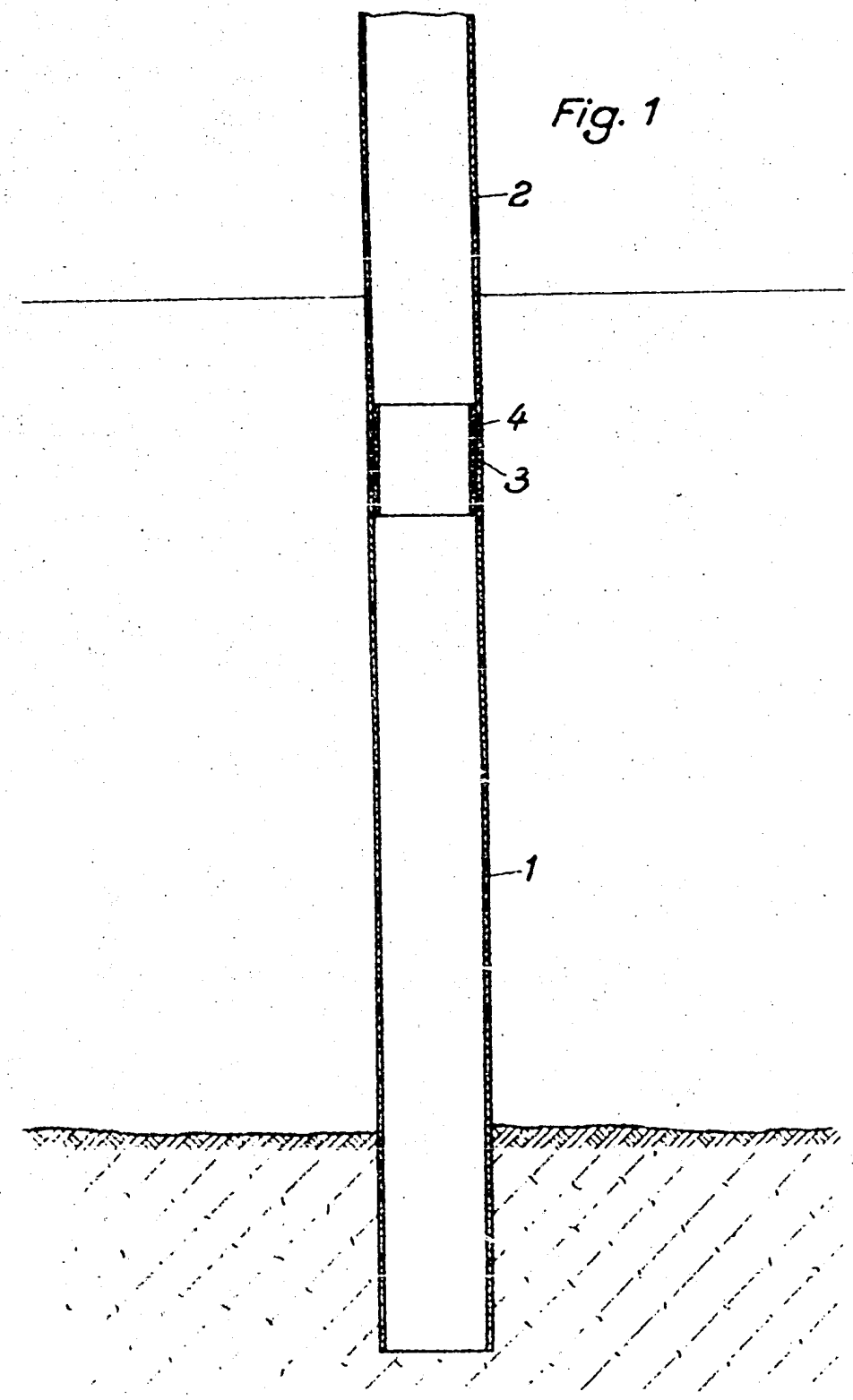


Fig. 2

Fig. 3

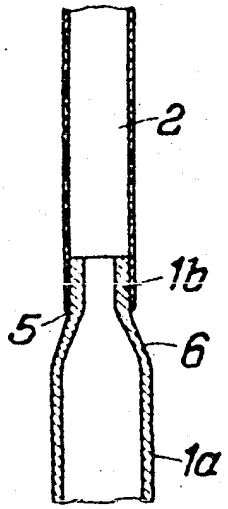
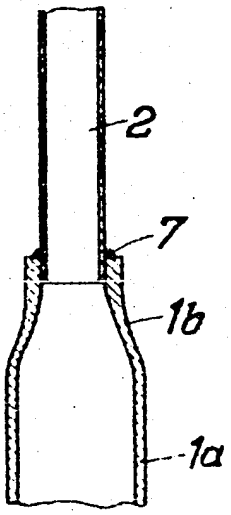
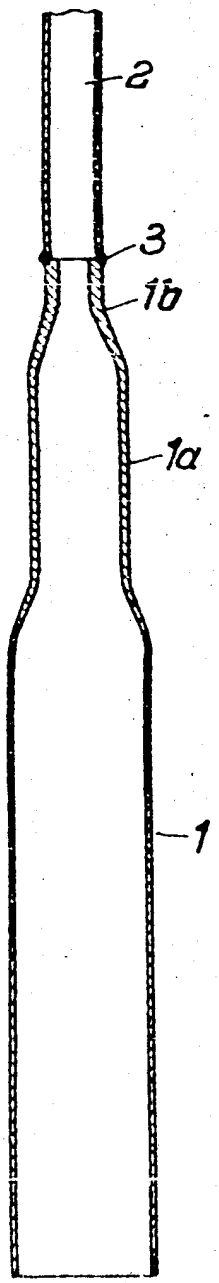


Fig. 4





705,891 COMPLETE SPECIFICATION
3 SHEETS
This drawing is a reproduction of the Original on a reduced scale.
SHEETS 2 & 3

Fig. 5

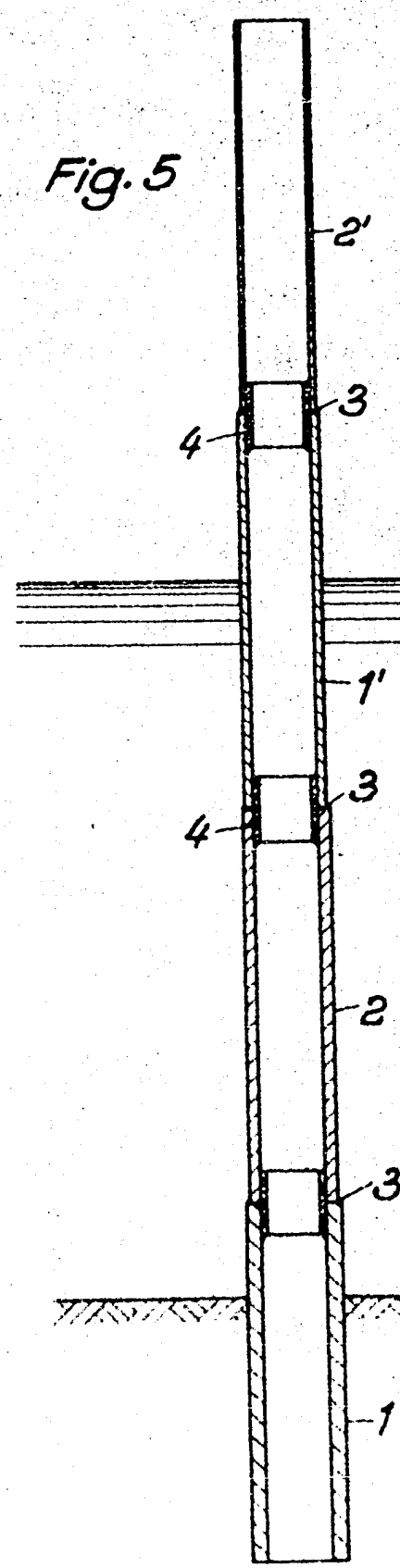


Fig. 6